PB-240 508

TROUT LAKE, ITASCA COUNTY, MINNESOTA

Pacific Northwest Environmental Research Laboratory

Prepared for:

National Environmental Research Center
Minnesota Pollution Control Agency
Minnesota National Guard

November 1974

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16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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I

REPORT
ON
TROUT LAKE
ITASCA COUNTY
MINNESOTA

EPA REGION V

WORKING PAPER No. 131

WITH THE COOPERATION OF THE

MINNESOTA POLLUTION CONTROL AGENCY

AND THE

MINNESOTA NATIONAL GUARD

NOVEMBER, 1974

II

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Minnesota Pollution Control Agency for professional involvement and to the Minnesota National Guard for conducting the tributary sampling phase of the Survey.

Grant J. Merritt, Director of the Minnesota Pollution Control Agency, John F. McGuire, Chief, and Joel G. Schilling, Biologist, of the Section of Surface and Groundwater, Division of Water Quality, provided invaluable lake documentation and counsel during the course of the Survey; and the staff of the Section of Municipal Works, Division of Water Quality, were most helpful in identifying point sources and soliciting municipal participation in the Survey.

Major General Chester J. Moeglein, the Adjutant General of Minnesota, and Project Officer Major Adrian Beltrand, who directed the volunteer efforts of the Minnesota National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

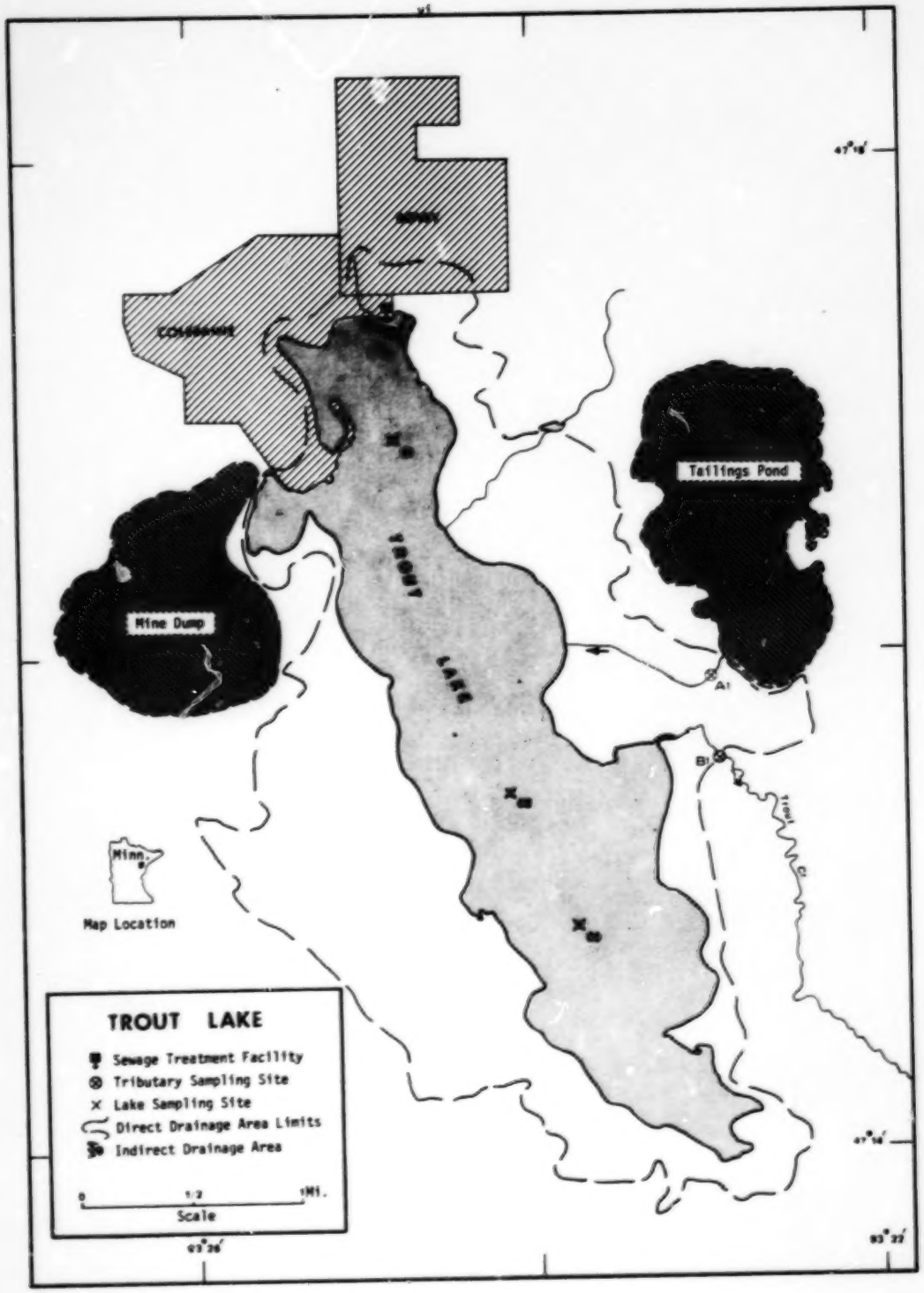
NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF MINNESOTA

LAKE NAME	COUNTY
Albert Lea	Freeborn
Andrusia	Beltrami
Badger	Polk
Bartlett	Koochiching
Bear	Freeborn
Bemidji	Beltrami
Big	Stearns
Big Stone	Big Stone, MN; Roberts, Grant, SD
Birch	Cass
Blackduck	Beltrami
Blackhoof	Crow Wing
Budd	Martin
Buffalo	Wright
Calhoun	Hennepin
Carlos	Douglas
Carrigan	Wright
Cass	Beltrami, Cass
Clearwater	Wright, Stearns
Cokato	Wright
Cranberry	Crow Wing
Darling	Douglas
Elbow	St. Louis
Embarass	St. Louis
Fall	Lake
Forest	Washington
Green	Kandiyohi
Gull	Cass
Heron	Jackson
Leech	Cass
Le Homme Dieu	Douglas
Lily	Blue Earth
Little	Grant
Lost	St. Louis

LAKE NAME	COUNTY
Madison	Blue Earth
Malmedal	Pope
Mashkenode	St. Louis
McQuade	St. Louis
Minnetonka	Hennepin
Minnewaska	Pope
Mud	Itasca
Nest	Kandiyohi
Pelican	St. Louis
Pepin	Goodhue, Wabasha, MN; Pierce, Pepin, WI
Rabbit	Crow Wing
Sakatah	Le Sueur
Shagawa	St. Louis
Silver	McLeod
Six Mile	St. Louis
Spring	Washington, Dakota
St. Croix	Washington, MN; St. Croix, Pierce, WI
St. Louis Bay	St. Louis, MN; Douglas, WI
Superior Bay	St. Louis, MN; Douglas, WI
Swan	Itasca
Trace	Todd
Trout	Itasca
Wagonga	Kandiyohi
Wallmark	Chisago
White Bear	Washington
Winona	Douglas
Wolf	Beltrami, Hubbard
Woodcock	Kandiyohi
Zumbro	Olmstead, Wabasha


Tailings Pond
Mine Dump
TROUT LAKE
Minn.
Map Location
TROUT LAKE
Sewage Treatment Facility
Tributary Sampling Site
Lake Sampling Site
Direct Drainage Area Limits
Indirect Drainage Area
0
1/2
1Mi.
Scale

TROUT LAKE

STORET NO. 2793

I. CONCLUSIONS

A. Trophic Condition:

Survey data show that Trout Lake is eutrophic. Of the 60 Minnesota lakes sampled in October, when all essentially were well-mixed, 28 had less mean total phosphorus, 36 had less mean dissolved phosphorus, but only seven had less mean inorganic nitrogen. For all data, only six lakes had greater Secchi disc transparency, and 13 had less chlorophyll a.

Hypolimnetic depression of dissolved oxygen occurred at all stations in July, and near-depletion occurred at all stations in September, 1972.

B. B. Rate-Limiting Nutrient:

Algal assay results show that Trout Lake was nitrogen limited at the time the assay sample was collected. Lake data show nitrogen limitation at the other sampling times as well (N/P ratios were less than 6/1).

C. Nutrient Controllability:

1. Point sources--During the sampling year, Trout Lake received a total phosphorus load at a rate in excess of that proposed by Vollenweider (in press) as "dangerous"; i.e., a

eutrophic rate (see page 13). Of this load, it is estimated that about 88% originated from the Coleraine-Bovey sewage treatment plant.

It is estimated that 80% phosphorus removal at the Coleraine-Bovey sewage treatment plant would reduce the loading rate to 0.8 lbs/acre/yr or 0.10 $g/m^2/yr$--the "permissible" (oligotrophic) rate.

It is concluded that phosphorus control at the Coleraine-Bovey sewage treatment plant would result in improvement of the trophic condition of Trout Lake.

2. Non-point sources--The phosphorus export of the unnamed stream (A-1) was a very low 13 $lbs/mi^2/yr$ (see page 13).

In all, it is estimated that non-point sources contributed less than 12% of the total phosphorus load reaching Trout Lake during the sampling year.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry†:

1. Surface area: 1,890 acres.
2. Mean depth: 50 feet.
3. Maximum depth: 135 feet.
4. Volume: 94,500 acre/feet.
5. Mean hydraulic retention time: 17.4 years.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area*	Mean flow*
Unnamed stream	1.5 mi^2	0.6 cfs
Minor tributaries & immediate drainage -	11.8 mi^2	6.9 cfs
Totals	13.3 mi^2	7.5 cfs

2. Outlet -

Trout Creek	16.2 mi^2**	7.5 cfs

C. Precipitation***:

1. Year of sampling: 22.6 inches.
2. Mean annual: 25.7 inches.

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† DNR lake survey map (1966); mean depth by random dot method.
* Drainage areas are accurate within ±5%; mean daily flows are accurate within ±10%; and ungaged flows are accurate within ±10 to 25% for drainage areas greater than 10 mi^2.
** Includes area of lake.
*** See Working Paper No. 1, "Survey Methods".

III. LAKE WATER QUALITY SUMMARY

Trout Lake was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from three stations on the lake and from a number of depths at each station (see map, page vi). During each visit, a single depth-integrated (15 feet to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the last visit, a single five-gallon depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 48 feet at station 1, 118 feet at station 2, and 40 feet at station 3.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	FALL VALUES (10/22/72) Mean	Median	Maximum
Temperature (Cent.)	7.2	7.4	7.4	7.6
Dissolved oxygen (mg/l)	7.4	9.0	9.2	9.6
Conductivity (μmhos)	300	316	320	320
pH (units)	8.1	8.1	8.1	8.2
Alkalinity (mg/l)	48	110	119	123
Total P (mg/l)	0.043	0.052	0.050	0.092
Dissolved P (mg/l)	0.036	0.040	0.040	0.049
NO_2 + NO_3 (mg/l)	0.020	0.049	0.050	0.070
Ammonia (mg/l)	0.020	0.037	0.030	0.080
		ALL VALUES		
Secchi disc (inches)	72	110	102	152

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
07/11/72	1. Dinobryon	2,333
	2. Flagellates	850
	3. Microcystis	669
	4. Anabaena	307
	5. Chroococcus	199
	Other genera	380
	Total	4,738
09/08/72	1. Microcystis	2,542
	2. Dinobryon	325
	3. Anabaena	132
	4. Chroococcus	96
	5. Melosira	48
	Other genera	170
	Total	3,313
10/22/72	1. Dinobryon	2,151
	2. Flagellates	1,283
	3. Asterionella	1,170
	4. Melosira	906
	5. Anabaena	792
	Other genera	3,245
	Total	9,547

2. Chlorophyll *a* -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
07/11/72	01	2.9
	02	4.8
	03	3.8
09/08/72	01	2.6
	02	4.3
	03	5.1
10/22/72	01	12.8
	02	12.7
	03	14.1

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.020	0.051	1.6
0.006 P	0.026	0.051	1.8
0.012 P	0.032	0.051	1.9
0.024 P	0.044	0.051	1.6
0.060 P	0.080	0.051	1.8
0.060 P + 10.0 N	0.080	10.051	43.8
10.0 N	0.020	10.051	13.2

2. Discussion -

The control yield of the assay alga, *Selenastrum capricornutum*, indicates that the potential primary productivity of Trout Lake was moderate at the time the assay sample was collected. Also, the lack of significant change in yields

with increased levels of orthophosphate until nitrogen also was added shows that the lake was nitrogen limited at the time the sample was collected. Note that the addition of only nitrogen resulted in a yield greater than the control yield.

Nitrogen limitation is also indicated by the field data for each of the sampling times (i.e., N/P ratios were less than 6/1 on all occasions).

IV. NUTRIENT LOADINGS
(See Appendix C for data)

For the determination of nutrient loadings, the Minnesota National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page vi), except for the high runoff months of April and May when two samples were collected. Sampling was begun in October, 1972, and was completed in October, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Minnesota District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated by using the means of the nutrient loads, in lbs/mi^2/year, at stations B-1, C-1, G-1, H-1, and J-1 of nearby Swan Lake and multiplying the means by the ZZ area in mi^2.

Nutrient loads from the sewage treatment plant serving Coleraine and Bovey were estimated at 2.5 lbs P and 7.5 lbs N/capita/year.

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* See Working Paper No. 1.

A. Waste Sources:

1. Known municipal -

Name	Pop. Served*	Treatment	Mean Flow (mgd)	Receiving Water
Coleraine-Bovey	1,086 858	trickling filter	0.194**	Trout Lake

2. Known industrial - None

* 1970 Census.
** Estimated at 100 gal/capita/day for combined population.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed stream (A-1)	20	0.4
b. Minor tributaries & immediate drainage (non-point load) -	330	5.9
c. Known municipal -		
Coleraine-Bovey	4,860	88.0
d. Septic tanks* -	20	0.4
e. Known industrial - None	-	-
f. Direct precipitation** -	290	5.3
Total	5,520	100.0

2. Outputs -

Lake outlet - Trout Creek 440

3. Net annual P accumulation - 5,080 pounds

* Estimate based on 31 shoreline dwellings (1969 U.S.G.S. map); see Working Paper No. 1.
** See Working Paper No. 1.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed stream (A-1)	530	1.1
b. Minor tributaries & immediate drainage (non-point load) -	13,860	29.2
c. Known municipal -		
Coleraine-Bovey	14,580	30.7
d. Septic tanks* -	730	1.5
e. Known industrial - None	-	-
f. Direct precipitation** -	17,820	37.5
Total	47,520	100.0

2. Outputs -

Lake outlet - Trout Creek 13,600

3. Net annual N accumulation - 33,920 pounds

* Estimate based on 31 shoreline dwellings (1969 U.S.G.S. map); see Working Paper No. 1.
** See Working Paper No. 1.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	lbs P/mi^2/yr	lbs N/mi^2/yr
Unnamed stream	13	353

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

	Total Phosphorus		Total Nitrogen	
Units	Total	Accumulated	Total	Accumulated
lbs/acre/yr	2.9	2.7	25.1	17.9
grams/m^2/yr	0.33	0.30	2.8	2.0

Vollenweider loading rates for phosphorus (g/m^2/yr) based on mean depth and mean hydraulic retention time of Trout Lake:

"Dangerous" (eutrophic rate)	0.20
"Permissible" (oligotrophic rate)	0.10

V. LITERATURE REVIEWED

Anonymous, 1973. Wastewater disposal facilities inventory. MPCA, Minneapolis.

Schilling, Joel, 1974. Personal communication (lake map). MPCA, Minneapolis.

Vollenweider, Richard A., (in press). Input-output models. Schweiz. A. Hydrol.

VII. APPENDICES

APPENDIX A

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR MINNESOTA 10/30/74

LAKE CODE 2791 TROUT LAKE

TOTAL DRAINAGE AREA OF LAKE 16.20

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
27931	1.54	0.11	0.07	0.26	2.38	1.61	1.35	0.55	0.23	0.41	0.46	0.27	0.24	0.66
27931	16.20	1.90	1.19	3.43	28.10	17.20	13.90	5.72	2.65	3.78	5.09	3.24	3.11	7.47
27977	14.70	2.47	1.44	4.27	25.20	15.20	12.90	5.10	2.27	3.38	4.40	2.75	3.32	6.89

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 16.20
SUM OF SUB-DRAINAGE AREAS = 16.24

TOTAL FLOW IN = 90.64
TOTAL FLOW OUT = 89.70

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
27931	10	72	0.21	14	0.20				
	11	72	0.29	19	0.30				
	12	72	0.30						
	1	73	0.23	9	0.20				
	2	73	0.13	18	0.10				
	3	73	0.55						
	4	73	0.71	5	0.70	19	0.60		
	5	73	1.14	5	0.80	20	1.20		
	6	73	1.09	14	0.90				
	7	73	0.48	26	0.55				
	8	73	0.50	20	0.53				
	9	73	0.51						
27931	10	72	2.14	14	1.90				
	11	72	3.42	19	3.20				
	12	72	3.88						
	1	73	3.74						
	2	73	2.34	18	2.30				
	3	73	8.08						
	4	73	8.43	5	8.60	19	7.30		
	5	73	14.30	5	9.20	20	14.00		
	6	73	11.10	14	9.70				
	7	73	5.03	26	4.80				
	8	73	5.80	20	6.10				
	9	73	4.73						
27977	10	72	2.63	14	1.50				
	11	72	3.40	19	2.70				
	12	72	4.13						
	1	73	4.87	9	4.80				
	2	73	2.74	18	2.90				
	3	73	9.01	17	13.00				
	4	73	7.56	5	7.70	19	6.60		
	5	73	12.60	5	7.60	20	11.00		
	6	73	10.30	14	9.00				
	7	73	4.49	26	5.20				
	8	73	4.47	20	5.20				
	9	73	4.23						

16

APPENDIX B

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/10/30

279301
47 16 48.0 093 24 57.0
TROUT LAKE
27 MINNESOTA

11EPALES 2111202
3 0042 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/07/11	06	25 0000			102	370	8.60	111	0.040	0.050	0.014	0.008
	06	25 0004	20.8	9.8		360	8.50	110	0.040	0.050	0.015	0.008
	06	25 0015	20.8	8.8		360	8.50	111	0.040	0.050	0.018	0.011
	06	25 0024	12.5	5.4		370	8.00	125	0.080	0.050	0.040	0.033
	06	25 0040	6.4	5.6		400	7.50	129	0.120	0.050	0.071	0.059
72/09/08	18	18 0000			144	298	8.70	116	0.030	0.050	0.015	0.009
	18	18 0004	17.5	9.3		281	8.78	116	0.030	0.050	0.015	0.010
	18	18 0015	17.2	9.4		280	8.75	119	0.030	0.050	0.017	0.009
	18	18 0025	16.1	6.5		290	8.35	122	0.030	0.050	0.020	0.012
	18	18 0035	9.1	2.0		328	7.35	133	0.130	0.060	0.190	0.084
	18	18 0048	6.8	2.0		320	7.30	134	0.190	0.060	0.107	0.101
72/10/22	14	30 0000			72	320	8.15	121	0.060	0.030	0.046	0.038
	14	30 0004	7.5	9.6		310	8.15	98	0.060	0.040	0.050	0.041
	14	30 0015	7.5	9.5		320	8.20	48	0.020	0.040	0.050	0.038
	14	30 0025	7.5	9.4		320	8.20	48	0.020	0.050	0.046	0.039
	14	30 0035	7.4	9.2		320	8.20	119	0.050	0.020	0.052	0.041
	14	30 0040	7.2	9.2		320	8.15	120	0.060	0.030	0.055	0.044

81

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/07/11	06	25 0000	2.9J
72/09/08	18	19 0000	2.4J
72/10/22	14	30 0000	12.8J

J VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 74/10/30

279302
47 15 38.0 093 24 20.0
TROUT LAKE
27 MINNESOTA

11FPALES
3

2111202
0090 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/07/11	07 10	0000			102	350	8.50	111	0.040	0.060	0.021	0.012
	07 10	0004	20.5	4.4		345	8.50	112	0.030	0.050	0.018	0.010
	07 10	0015	20.5	4.4		340	8.50	111	0.040	0.060	0.018	0.011
	07 10	0043	6.4	5.4		400	7.60	128	0.080	0.050	0.046	0.034
	07 10	0074	6.3	5.4		400	7.50	128	0.110	0.050	0.051	0.043
72/09/09	17 35	0000			138	283	8.70	116	0.030	0.050	0.017	0.009
	17 35	0004	17.7	9.4		280	8.75	118	0.030	0.050	0.021	0.010
	17 35	0015	17.7	9.1		280	8.70	120	0.030	0.050	0.019	0.011
	17 35	0035	16.4	9.2		280	8.70	108	0.030	0.040	0.016	0.010
	17 35	0035	9.4	2.4		320	7.40	128	0.060	0.030	0.045	0.039
	17 35	0060	6.4	2.4		322	7.35	130	0.150	0.040	0.078	0.071
	17 35	0080	6.2	2.6		332	7.30	130	0.210	0.050	0.096	0.091
	17 35	0100	5.4	2.2		325	7.30	129	0.250	0.040	0.110	0.103
	17 35	0106	5.4	1.4		335	7.30	129	0.270	0.090	0.141	0.136
72/10/22	13 50	0000			46	310	8.10	119	0.050	0.030	0.043	0.037
	13 50	0004	7.6	8.4		315	8.10	119	0.050	0.020	0.050	0.049
	13 50	0015	7.6	8.4		315	8.10	119	0.050	0.030	0.047	0.040
	13 50	0040	7.5	8.4		320	8.15	122	0.060	0.040	0.049	0.040
	13 50	0045	7.5	8.0		320	8.10	123	0.050	0.050	0.048	0.047
	13 50	0135	7.3	8.0		315	8.11	122	0.060	0.060	0.057	0.042
	13 50	0114	7.3	8.0		320	8.15	122	0.070	0.080	0.055	0.041

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLOROPHYL A UG/L
72/07/11	07 10	0000	4.04
72/09/09	17 35	0000	4.33
72/10/22	13 50	0000	12.73

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J VALUE KNOWN TO BE IN ERROR

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STORET RETRIEVAL DATE 74/10/30

279303
47 14 52.0 093 23 50.0
TROUT LAKE
27 MINNESOTA

11EPALES 2111202
3 0034 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/07/11	08	00 0000			102	350	8.50	111	0.040	0.050	0.023	0.010
	08	00 0004	19.9	8.8				112	0.040	0.060	0.019	0.009
	08	00 0015	19.7	9.4		360	8.50	113	0.040	0.060	0.017	0.010
	08	00 0031	7.9	5.8		400	7.50	130	0.080	0.060	0.043	0.024
72/09/09	16	45 0000	17.7		152	282	8.70	122	0.030	0.060	0.016	0.009
	16	45 0004	17.7	9.2		300	8.70	121	0.040	0.070	0.016	0.011
	16	45 0015	17.6	9.5		298	8.70	120	0.030	0.050	0.020	0.012
	16	45 0025	17.0	8.7		299	8.65	120	0.030	0.050	0.017	0.010
	16	45 0030	15.0	7.0		299	8.70	123	0.020	0.040	0.020	0.013
	16	45 0035	9.9	1.9		340	7.40	137	0.040	0.040	0.032	0.028
	16	45 0040	8.4	1.8		340	7.35	137	0.090	0.050	0.056	0.052
72/10/22	13	15 0000			96	320	8.10	123	0.050	0.040	0.054	0.036
	13	15 0004	7.4	8.9		320	8.10	121	0.040	0.020	0.043	0.036
	13	15 0015	7.4	8.9		320	8.10	117	0.050	0.030	0.051	0.038
	13	15 0023	7.4	9.2		300	8.10	114	0.040	0.020	0.054	0.036
	13	15 0030	7.4	7.4		310	8.10	114	0.050	0.030	0.092	0.040

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/07/11	08	00 0000	3.8J
72/09/09	16	45 0000	5.1J
72/10/22	13	15 0000	14.1J

J VALUE KNOWN TO BE IN ERROR

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APPENDIX C

TRIBUTARY DATA

STORET RETRIEVAL DATE 74/11/19

2793A1 LS2793A1
47 16 00.0 093 23 00.0
UNNAMED STREAM INTO TROUT LAKE
27 7.5 BOVEY
T/TROUT LAKE
CO HWY 10 XING 2.5 MI SE OFBOVEY
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	[illegible] N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/14	09 45		0.552	0.350	0.045	0.005K	0.020
72/11/19	14 55		0.224	0.420	0.034	0.006	0.016
73/04/14	09 30		0.044	0.150	0.126	0.010	0.030
73/05/05	10 00		0.014	0.290	0.011	0.005K	0.015
73/05/20	10 50		0.024	0.520	0.010	0.006	0.025
73/06/14	09 45		0.014	0.260	0.031	0.010	0.025
73/07/25	14 20		0.014	0.460	0.011	0.005K	0.010
73/08/21	13 25		0.014	0.440	0.026	0.005K	0.010
73/10/03	14 30		0.014	0.340	0.017	0.012	0.015

K VALUE KNOWN TO BE LESS THAN INDICATED

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START RETRIEVAL DATE 79/12/20

2793M1 LS2793P1
47 15 30.0 093 23 00.0
TROUT CREEK
27 7.5 ROVEY
OUTROUT LAKE
AT CO HWY 16 XING 3 MI SE OF ROVEY
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	[illegible] DISS-SUS TOTAL MG/L	[illegible] TOT R+FL MG/L	[illegible] NH4+NH TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/16	09 05		0.003	0.350	0.072	0.006	0.015
72/11/19	14 45		0.028	0.370	0.050	0.014	0.024
73/04/05	13 45		0.013	1.500	0.006	0.006	0.035
73/04/19	09 40		0.013	0.120	0.025	0.010	0.040
73/05/03	10 10		0.013	0.440	0.016	0.009	0.035
73/05/23	11 00		0.013	1.333	0.0255	0.013	0.040
73/06/14	08 25		0.013	0.750	0.036	0.015	0.030
73/07/24	13 25		0.013	0.250	0.011	0.016	0.035
73/08/22	13 25		0.013	0.333	0.045	0.015	0.030
73/10/03	14 25		0.013	1.750	0.026	0.011	0.030

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K VALUE KNOWN TO BE LESS THAN INDICATED